IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Fixed and Broadcast Communications (3)

Author: Dr. Marina Ploeckl
HPS GmbH, Germany

Mr. Javier García Garrido
HPS GmbH, Germany
Mr. Maurizio Lori
HPS GmbH, Germany
Mr. Stephan Endler
HPS GmbH, Germany
Mr. Jean-Christophe Angevain
ESA, The Netherlands
Mr. Alexander Ihle
ESA, The Netherlands

L-, X/KU-, AND KA-BAND REFLECTIVE MESH FOR LARGE DEPLOYABLE REFLECTOR SUBSYSTEMS

Abstract

In the next years, Europe is targeting several space missions in order to achieve different goals. The improvement of telecommunications for example with Wi-Fi access systems and big data transfer via satellites is one objective. Earth Observation is also another important topic to be addressed in the framework of future space missions. For these missions the satellites use Large Deployable Reflector Subsystems (LDRS). These large reflectors have mainly 4 m up to 18 m projected mesh aperture diameter. The frequency range covered by such reflectors is typically ranging from low frequency such as L-band to high frequency such as Ka-band. One of the key elements of the LDRS is the reflective surface, which is used to reflect the electromagnetic waves that are either radiated towards the earth or collected from the earth's surface during the observation. This RF reflective surface is typically composed of a very delicate technical textile. This metallic textile is a knitted mesh in general made of single ultra-thin gold-plated metallic wires. In this study three different mesh types were knitted for the frequency ranges: L-band, X/Ku-band, and Ka-band. These different mesh types differ in their density, i.e. in the number of openings per inch (OPI). The key characteristics of the mesh such as its mechanical behavior and its radio frequency properties are verified by tests. In particular, the stiffness of the mesh at the optimal RF working point, in which the mesh material has its best RF properties from RF reflectivity loss and passive intermodulation standpoint, is of paramount importance for the assembly phase of the mesh on the LDRS. Due to the fact that the mesh knitting pattern has a strong influence on the stiffness behavior of the mesh along the longitudinal and the transversal directions that are both defined by the manufacturing direction, the stiffness along both directions needs to be characterized. Furthermore, since the space missions have to deal with more and more debris, the probability of a possible collision with the LDRS with a very large aperture cannot be neglected. In order to mitigate this risk, the resistance to tearing and the tear propagation behavior of the mesh are required to be checked via experiments. The measurement results show that the performance of the manufactured mesh is in compliance with the requirements and is therefore deemed as suitable for use as LDRS reflective surface in the frequency range from L-band to Ka-band.